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ARTICLE XI.

Collection of Observations on the Solar Eclipse of November 30th, 1834, made at Philadelphia, Haverford, West-Hills, Baltimore, the University of Virginia, Norfolk, Cincinnati and Nashville. Reported March 6th, 1835.

THE Committee appointed to make a collection of Observations on the recent Solar Eclipse, respectfully report the following for publication in the Transactions of the Society.

ALEX. DALLAS BACHE.

JOS. ROBERTS, JUN.

ISAIAH LUKENS.

Memorandum of Observations of the Solar Eclipse of November 30th, 1834, made at the University of Pennsylvania. By Edward H. Courtenay, Professor of Mathematics in the University of Pennsylvania.

During one or two hours immediately preceding the commencement of the eclipse, the sun was frequently obscured by clouds; but these, although not entirely dispersed, had disappeared sufficiently to permit a very satisfactory observation of the commencement. For several seconds (say five or six) previous to the first distinct impression on the sun's disk, a slight tremulous motion was distinctly observed near that

point of the limb at which the eclipse was expected to commence. This served as an additional guide to the eye, which was accordingly found to be directed very accurately to the point at which the indentation first occurred. The limb of the sun at this time was beautifully defined; soon after the commencement, the clouds began again to accumulate, and at the period of greatest obscuration the sun was entirely concealed. About twenty minutes before the end the clouds had again dispersed, leaving the sun much brighter than at any previous period during the eclipse, and giving promise of a highly satisfactory observation of the end; but at fifteen or twenty seconds before the final separation of the disks a light fleecy cloud passed before them, alternately concealing the sun and permitting him to be seen. The effect of this was to dazzle the eye, and to render the vision so far imperfect that the instant of separation of the disks could not be fixed as satisfactorily as that of the commencement. The observations were made with a sixty inch refractor by Dollond belonging to the University of Pennsylvania, the diameter of the object glass being three and three-fourths inches. The time keeper was a chronometer of excellent character by Parkinson and Frodsham, and its error and rate were ascertained by frequent transits of the sun and stars on the day of the eclipse and for several days previous. The limbs of the sun and moon, when not obscured by clouds, were defined as distinctly as could have been desired. The colour of the sun's disk, as seen through the dark glass used, was a bright orange extremely agreeable to the eye; that of the moon intensely black.

The times observed, reduced to the meridian of Independence Hall, were as follows:

| | h. | m. | sec. |
|---------------|----|----|------|
| Commencement, | 1 | 00 | 10.5 |
| End, | 3 | 37 | 51.5 |
| Duration, | 2 | 37 | 41 |

Observations of the temperature were likewise made with two thermometers by Pastorelli (the bulb being uncoated); the one exposed to the sun's rays on the south side of the university, the other well sheltered from the sun and having a north western exposure. The sudden and frequent fluctuations of the thermometer in the sun are attributable to the frequent interposition of clouds.

| Hour. | Therm. in Sun. | Therm. in Shade. | |
|------------|-------------------|---------------------|--|
| 10 15 A.M. | 64 | 44 | Very clear. Wind N. W. |
| 10 30 A.M. | 64 | 46 | Very clear. Wind N. W. |
| 11 00 A.M. | 70 | 46 | Very clear. Wind N. W. |
| 11 30 A.M. | 63 | 47 | Thin white clouds. |
| 12 00 M. | 59 | 47 | Sun shining through clouds. |
| 12 30 P.M. | 54 | 47 | Clouds thicker. |
| 12 45 P.M. | 64 | 48 | Sun quite bright. |
| 12 55 P.M. | 66 | 48 | Sun quite bright. } Commencement of Eclipse. |
| 1 05 P.M. | 68 | 48 | Sun quite bright. } |
| 1 15 P.M. | 58 | 48 | Sun considerably obscured. |
| 1 30 P.M. | 55 | 48 | Sun considerably obscured. |
| 1 45 P.M. | 52 | 47 | Sun nearly invisible. |
| 2 00 P.M. | 50 | 47 | Sun just visible. |
| 2 10 P.M. | 48 | 46½ | Sun entirely gone. |
| 2 20 P.M. | 48 | 46 | Sun entirely gone. Greatest obscuration. |
| 2 30 P.M. | 48 | 46 | Clouds thinner. Sun can be seen. |
| 2 40 P.M. | 48 | 46 | Sun continues to grow brighter. |
| 2 50 P.M. | 48½ | 46 | Sun quite bright. |
| 3 00 P.M. | 48½ | 45½ | Sun quite bright. |
| 3 15 P.M. | 48½ | 45½ | Sun quite bright. |
| 3 30 P.M. | 54 | 46 | Sun very bright. |
| 3 45 P.M. | 50 | 46 | Sun very bright. |

Observations of a hollow magnetic needle (by Lukens) suspended horizontally by silk fibres, and placed in one of the west windows of the University.

| Hour. | Division indicated by South Pole. | Hour. | Division indicated by South Pole. |
|------------|--------------------------------------|-----------|--------------------------------------|
| 11 00 A.M. | 25' W. | 2 10 P.M. | 24' W. |
| 11 30 A.M. | 27 W. | 2 20 P.M. | 23 W. |
| 12 00 M. | 30 W. | 2 40 P.M. | 23 W. |
| 12 30 P.M. | 28 W. | 2 50 P.M. | 23 W. |
| 12 45 P.M. | 28 W. | 3 00 P.M. | 24 W. |
| 1 15 P.M. | 29 W. | 3 15 P.M. | 24 W. |
| 1 30 P.M. | 30 W. | 3 30 P.M. | 26 W. |
| 1 45 P.M. | 29 W. | 3 45 P.M. | 24 W. |
| 2 00 P.M. | 25 W. | | |

The divisions pointed out by the needle indicate nothing as to the *actual amount of the magnetic variation*, but simply the change in variation during the eclipse.

Observations on the Eclipse of the Sun November 30th, 1834, made at Friends' Observatory, Fourth Street, Philadelphia. By Joseph Roberts, Jun.

The morning was clear and without clouds till about eleven o'clock, when the eastern, western and southern sky became overcast with thin white clouds moving from the west. At noon determined the state of the clock by the fixed transit instrument. The beginning of the eclipse, observed with an achromatic telescope with a power of about 38, happened at 1 h. 0 m. 15.85 sec. mean civil time, corrected for the rate of the clock, determined by transits both before and after the eclipse. The observation of the beginning was very good; but from a few minutes after the beginning till some time after the end of the eclipse there was a constant succession of clouds between the sun and the observer, often so dense as to render the sun invisible; at the time of the greatest obscuration the sun was visible through thin clouds. Determined the magnitude of the eclipse when compared with a measure of the sun's diameter, taken with a Troughton micrometer near noon of the same day. The obscured part measured 10.755 digits, which differs from the calculation about a three hundredth part of a digit, or five seconds. This observation was made under unfavourable circumstances. The end of the eclipse happened at 3 h. 37 m. 45 sec. mean time corrected. A haze about the sun may have caused the disappearance of the moon a few seconds before the actual end of the eclipse, in which case the latter number should be increased a few seconds.

Observations on the Solar Eclipse of November 30th, 1834, made at Philadelphia and Germantown, Pennsylvania. Communicated by S. C. Walker.

The following observations of the Solar Eclipse of November 30th have been communicated to me by the respective observers. They are all expressed in mean solar time of the Hall of Independence, longitude 5 h. 0 m. 43.9 sec., latitude $39^{\circ} 56' 59''$.

| Beginning. | End. | Observer. | Place of Observation. |
|------------|------------|------------|----------------------------------|
| h. m. sec. | h. m. sec. | | |
| 1 0 15.3 | 3 37 55.3 | Wistar. | C. Wistar's House, Germantown. |
| | 54.3 | Lukens. | |
| | 58.8 | T. M'Euen. | T. M'Euen's House, Philadelphia. |
| 10.3 | 38 01.3 | C. M'Euen. | |
| | 37 52.9 | Young. | Third Street, near South Street. |
| 14.2 | 14.4 | Espy. | 100 south Eighth Street. |
| 20.0 | | Riggs. | |
| 15.8 | 38 00.2 | Walker. | |

Observations of the temperature during the eclipse. By T. M'Euen.

| Hour. | Therm. Fahr. | Hour. | Therm. Fahr. |
|-------|--------------|-------|-------------------|
| 1 12 | 50°.5 | 2 40 | 45°.00 |
| 1 24 | 50 .0 | 2 50 | 45 .00 |
| 1 30 | 49 .0 | 2 55 | Dew point, 24 .00 |
| 1 42 | 48 .0 | 3 00 | 44 .75 |
| 1 58 | 47 .25 | 3 15 | 44 .50 |
| 2 10 | 46 .5 | 3 45 | 44 .50 |
| 2 20 | 46 .0 | 3 55 | 44 .00 |
| 2 30 | 45 .25 | | |

Note of Meteorological Observations made during the Solar Eclipse of November 30th, 1834.
By A. D. Bache, Professor of Natural Philosophy and Chemistry in the University of Pennsylvania.

The day of the eclipse was one of a series of days above the ordinary temperature of the season; a thermometer which on Thursday the 4th of December stood in the shade at 2 P.M. at $35\frac{1}{2}^{\circ}$ Fahrenheit, stood in the same place on November 28th at 51° , at the same time on the 29th at 48° , on the 1st of December at 51° , on the 2d at 47° , and on the day of the eclipse at $45\frac{1}{4}^{\circ}$. During the eclipse the thermometer in the shade fell from 49° at 1 o'clock to $43\frac{1}{2}^{\circ}$ at 2 h. 22 m., the temperature being obtained by swinging the thermometer. On the following day, which was cloudy, the clouds being however less dense than on the 30th, the thermometer rose during the same time $2\frac{1}{2}^{\circ}$; and on the 28th, at which time there were fewer clouds, $2\frac{3}{4}^{\circ}$. The

effect of the clouds in preventing the rise of the thermometer being taken at $\frac{3}{4}$ of a degree, gives, in addition to a rise of 2° prevented, a depression of $5\frac{1}{2}^{\circ}$ produced, making $7\frac{1}{2}^{\circ}$ for the effect on the air. In the eclipse of 1831 the observed effect on the temperature of the air, not taking into account the rise which would in other circumstances have been produced, was $4\frac{3}{4}^{\circ}$ Fahrenheit, which was, however, much more felt than the present, the fall being from $35\frac{1}{2}^{\circ}$ Fahrenheit to $30\frac{3}{4}^{\circ}$.

A thermometer with the bulb blackened by writing ink, and confined in a plate glass case, fell from 101° , at which it stood at 1 P.M., to 46° at 2 h. 30 m., which was the lowest point that it attained, the depression amounting to 55° in one hour and a half, from the effect of the clouds and of the eclipse. In the eclipse of 1831 the depression of a similar instrument not protected from the air was 36° . The variable effect of the temperature of the air renders such comparisons very vague.

The time of greatest obscuration from clouds coincided nearly with that from the eclipse, and the varying density of the clouds rendered the photometer of no service, and disappointed me in observations which had been arranged for that instrument. The photometer, which in 1831 exhibited at the time of greatest obscuration a quantity of light from the direct action of the sun amounting to 4° in 56.5, or $\frac{1}{14}$, gave but 2 for the same quantity on the present occasion. This remark applies only to the direct light, for that which was reflected was greater than in 1831. The dew point, which at 7 A.M. was at 28° , fell, on the formation of clouds, and was at 1 h. 40 m. 24° , and at 2 h. 40 m. $23\frac{1}{2}^{\circ}$.

A series of magnetic observations on the dip, intensity and variation were made, and the results will at a future date be communicated. They may have an important bearing on the theory of the diurnal variation.

Observations of the times of beginning and end of the Eclipse of the Sun, 11th month 30th, 1834, made at Haverford School, Latitude 40° 1' 12'' North. By J. Gummere, Professor of Natural Philosophy and Mathematics.

| | h. | m. | sec. |
|------------|----|----|------|
| Beginning, | 0 | 59 | 12 |
| End, | 3 | 36 | 53 |

The state and rate of the clock were determined by a number of observations of the sun's meridian passage, including one on the day of the eclipse: the state of the transit instrument, a twenty inch one by Dollond, being carefully examined by observed transits of high and low stars. The observations of the eclipse were made with a forty-six inch achromatic by Tully and Sons, just received. It has four astronomical eye pieces, but was not accompanied by a statement of their powers, and I have not yet had leisure to ascertain them. The lowest was used; it is probably about forty. At the time of commencement part of a small cloud, too dense to admit of distinct vision through it, obscured the sun for a few seconds, in consequence of which the time of beginning, as given above, may be in error to the amount of three or four seconds. The observation of the end was free from obstruction, and is, I think, accurate. The latitude of our place may be regarded as a near approximation. I have not yet made a sufficient number of observations to consider it accurately determined.

Observations on the Solar Eclipse of November 30th 1834, made at West-Hills, Long Island. By F. R. Hassler, Esq. Communicated by Mr John A. Dahlgren, of the United States Navy.

By direction of Mr Hassler the following observations of the late solar eclipse, made by him at West-Hills, Long Island, 30th November 1834, are communicated.

| | h. | m. | sec. |
|----------------|----|----|------------------|
| First contact, | 1 | 09 | 53.93 mean time, |
| Last contact, | 3 | 45 | 18.65 mean time, |

Latitude, $40^{\circ} 48' 47''.82$ N.

Assumed longitude, 4 h. 53 m. 52.7 sec. W.

The station is one of the principal points of the triangulation selected by Mr Hassler for the coast survey.

Observations were made on the day of the eclipse, by order of Mr Hassler, to determine the rate and error of the chronometers and astronomical clock. The apparent time was deduced from the sun's Z. D. in series of ten repetitions, each measured by the repeating circle.

Altitudes were also measured with a reflecting circle of double repetition on Mr Hassler's principle: but as one of the sets was interrupted by the tremor of the mercury from the motion of some of the spectators, the series was rendered imperfect, and could not therefore be used. The latitude was determined by two series on the sun, and seven on α Ursæ Minoris, being all the weather admitted of during the month of November.

Observations of the Solar Eclipse of November 30th, 1834, made at Baltimore. By Lewis Brantz.

The place of observation is about one mile west from Monument Square. The latitude being $39^{\circ} 17' 12''$ W. The time was observed minutely by a chronometer of Parkinson and Frodsham, whose rate has for some time back been $0''.5$ slow, and the local mean time was ascertained by sets of altitudes of the sun, accurately observed on the forenoons immediately preceding and succeeding the eclipse.

The contacts were observed by a Dollond's achromatic telescope with a power of eighty-five, assisted by a lesser one of about thirty. The two observations agreed so nearly as not to admit of any distinction.

| | | | | |
|------------|----|----|-----------------|-------------------------|
| | h. | m. | sec. | |
| Beginning, | 12 | 51 | 58 | mean time at Baltimore, |
| End, | 3 | 31 | $29\frac{1}{2}$ | do. do. |

The temperature by a thermometer exposed to the sun, and by another in a northern exposure, was as follows:

| | Therm. in Sun. | Therm. to North. |
|--------|----------------|------------------|
| 12 M. | 66° Fahr. | 50° Fahr. |
| 1 P.M. | 66 | 51 |
| 2 P.M. | 55 | 49 |
| 3 P.M. | 62 | 50 |

Times of beginning and end of the Solar Eclipse of November 30th, 1834, observed at the University of Virginia. By R. M. Patterson, Professor of Natural Philosophy in the University of Virginia.

| | h. | m. | sec. |
|---------------|----|----|------|
| Commencement, | 0 | 41 | 11 |
| End, | 3 | 23 | 43 |

In 1831 the thermometer in the sun was at 33° Fahrenheit in the middle of the eclipse, and at 51° at the end. On this occasion it was at 54½° to 57° at the middle, 70° to 76° at the beginning, and at 66° at the end; two different thermometers being noted. The thermometer in the shade varied only a degree and a half.

Register of Observations made at Norfolk, Virginia. By Captain A. Talcott, of Corps of Engineers. Latitude of station 36° 51' 10". November 30th, 1834.

| Time by pocket chron. | | | Alt. of sun with 18 inch repeating circle. | | | | |
|-----------------------|----|-----------|--|---|---|---------------|-------------|
| h. | m. | sec. | | | | | |
| 8 | 32 | 08.5 (—)* | A | 0 | 0 | 0'' | |
| | 33 | 06 (—) | B | | | 2 | |
| | 34 | 02 (—) | C | | | 5 | |
| Reversed | | | D | | | 0 | |
| | 35 | 44 (—) | A | | | 146° 09' 20'' | Barom. 30.3 |
| | 36 | 42 (—) | B | | | 9 45 | Therm. 48° |
| | 37 | 39 (—) | C | | | 9 45 | |
| | | | D | | | 9 25 | |

* (—) Sun's upper limb; (—) Sun's lower limb.

Again,

| h. | m. | sec. | | | |
|----------|------|------|---|----------------------------------|---------------|
| 8 | 43 | 03.5 | ⌋ | A, B, C and D same as preceding. | |
| | 44 | 02 | ⌋ | | |
| | 45 | 00 | ⌋ | | |
| Reversed | | | | | |
| | 48 | 11 | ⌋ | A | 289° 37' 30'' |
| | Lost | | ⌋ | B | 05 |
| | 50 | 10 | ⌋ | C | 00 |
| | | | | D | 10 |
| | | | | | Barom. 30.3 |
| | | | | | Therm. 48° |

After measuring the foregoing altitudes of the sun, the level was clamped, and the following observations for equal altitudes made.

| h. | m. | sec. | | h. | m. | sec. | | | |
|----|----|------|--------|---|----|------|-------------|--------------|------------|
| 8 | 57 | 54 | A.M. (| Barom. 30.29 | 2 | 27 | 42.4 P.M. (| Barom. 30.32 | |
| | 58 | 57 | A.M. (| Therm. 48° | | 26 | 40 | P.M. (| Therm. 50° |
| | 59 | 59 | A.M. (| | | 25 | 38 | | |
| 9 | 02 | 07 | A.M. (| } The lower limb of the sun was obscured by the moon P.M. | | | | | |
| | 03 | 11 | A.M. (| | | | | | |
| | 04 | 14 | A.M. (| | | | | | |

Time by chron.

Alt. of sun with 18 inch repeating circle.

| h. | m. | sec. | | | |
|----------|----|------|--------|---|---------------|
| 3 | 35 | 06 | P.M. ⌋ | A | 289° 37' 10'' |
| | 35 | 56 | P.M. ⌋ | B | 36 30 |
| | 36 | 46 | P.M. ⌋ | C | 36 35 |
| Reversed | | | | D | 36 50 |
| | 38 | 10 | P.M. ⌋ | A | 90 26 55 |
| | 39 | 01.2 | P.M. ⌋ | B | 27 10 |
| | 39 | 50 | P.M. ⌋ | C | 27 25 |
| | | | | D | 27 05 |

Again,

| h. | m. | sec. | | | | |
|----------|----|------|--------|--------------------------|--------------|--------------|
| 3 | 47 | 48 | P.M. ☾ | A, B, C and D as before. | | |
| | 48 | 38 | P.M. ☾ | | | |
| | 49 | 26 | P.M. ☾ | | | |
| Reversed | | | | | | |
| | 50 | 56 | P.M. ☾ | A | 255° 23' 57" | Barom. 30.34 |
| | 51 | 45.2 | P.M. ☾ | B | 24 00 | Therm. 48° |
| | 52 | 34 | P.M. ☾ | C | 23 45 | |
| | | | | D | 23 40 | |

| h. | m. | sec. | |
|----|----|------|--------------------------|
| 0 | 49 | 52 | Commencement of eclipse. |
| 2 | 14 | 00 | Greatest obscuration. |
| 3 | 30 | 52 | End of eclipse. |

The v. sine of crescent measured by 257 divisions of micrometer scale, the value of each division being .45191" or 45".191 to each thread of the screw.

The foregoing observations for time were made by setting the telescope of the circle, and taking the transit of the sun's first limb, and then reversed. It was thought that the interval, if both limbs were observed, would be too great to allow of taking an arithmetical mean for the time. The second limb was taken after reversing in all but the first morning observation, when the first limb was observed before and after reversing.

To correct, if necessary, any inequality in the rate of the pocket chronometer, in the correctness of which I had little confidence, as it was habitually used as a pocket watch, I compared it about every hour with the clock, which was set going for the occasion. The rate of the clock could be depended upon for uniformity, but what that was, was unknown, as it had been moved in the interval of my absence, and there was no opportunity, owing to the bad weather, of ascertaining the true time or rate until Sunday the day of the eclipse.

Comparison of clock and chronometer:—

| | h. | m. | sec. | h. | m. | sec. | h. | m. | sec. | h. | m. | sec. |
|--------|----|----|-------|----|----|-------|----|----|------|----|----|-------|
| Clock, | 20 | 41 | 00 | 21 | 28 | 00 | 22 | 28 | 00 | 24 | 00 | 00 |
| Chron. | 20 | 22 | 10.13 | 21 | 09 | 08.13 | 22 | 09 | 05.6 | 23 | 41 | 01.07 |
| Clock, | 00 | 45 | 00 | 1 | 45 | 00 | 3 | 05 | 00 | 4 | 19 | 00 |
| Chron. | 00 | 25 | 58.4 | 1 | 25 | 56 | 2 | 45 | 52 | 3 | 59 | 48.5 |

In addition to the foregoing observations, the following measurements were made of the chord of the obscured segment of the sun with a spider's line micrometer. The telescope to which it was applied was not mounted on the equatorial, and the measurements were not therefore made with as great accuracy as they could have been under more favourable circumstances. They are, however, appended, that they may be examined and used if of any value. The value of the micrometer, as before stated, is .45191" for each division. By taking a mean of several measurements of the sun's diameter when on or near the meridian, say .452".

| Time by Chronometer. | | | Div. of Micrometer. | Time by Chronometer. | | | Div. of Micrometer. |
|----------------------|----|------|---------------------|----------------------|----|------|---------------------|
| h. | m. | sec. | | h. | m. | sec. | |
| 0 | 52 | 16.2 | 1087 | 3 | 17 | 16.3 | 2516 |
| | 53 | 20 | 1288 | | 18 | 08 | 2451 |
| | 54 | 20.2 | 1434 | | 19 | 58.4 | 2373 |
| | 55 | 12 | 1530.5 | | 20 | 36.3 | 2305 |
| | 56 | 22.3 | 1701 | | 21 | 34 | 2219 |
| | 57 | 56 | 1844 | | 23 | 38 | 1892 |
| | 58 | 36.2 | 1931 | | 24 | 22 | 1827 |
| | 59 | 36.2 | 2040 | | 25 | 08 | 1724 |
| 1 | 00 | 08.4 | 2095 | | 25 | 56 | 1616 |
| | 04 | 58.4 | 2489 | | 26 | 30 | 1520 |
| | 05 | 42.3 | 2543 | | 27 | 08.4 | 1409 |
| | 13 | 58.4 | 3064 | | 28 | 10 | 1241 |
| | 14 | 44 | 3102 | | 28 | 52 | 1053 |
| 3 | 13 | 00 | 2839 | | 29 | 13 | 946 |
| | 14 | 16.2 | 2750 | | 29 | 42.4 | 792 |
| | 15 | 30 | 2647 | | 30 | 26 | 502 |
| | 16 | 26 | 2580 | | | | |

The following measurements were made of the versed sines of the unobscured part of the sun's disk. The difficulty of measuring these accurately, was much greater than of measuring the chords; in those the perpendicular hair could be made to coincide with the angles of the disk, and there was no doubt of the measured line being perpendicular to the parallel lines of the micrometer. In measuring the versed sines, the eye alone could decide, except so far as it could be aided by first bringing the perpendicular line to coincide with the angular points, and then moving the telescope in azimuth to bring the parallel wires on the concave and convex parts of the crescent; but this line changed its angle with the horizon so rapidly, that little assistance could be derived from this practice.

| Time by Chronometer. | | | Div. of Micrometer. |
|----------------------|----|------|---------------------|
| h. | m. | sec. | |
| 1 | 17 | 40 | 2915 |
| | 21 | 12 | 2762 |
| | 33 | 18 | 2150 |
| | 39 | 28 | 1833 |
| | 48 | 16 | 1381 |
| | 50 | 28 | 1263 |
| 2 | 08 | 48 | 378 |
| | 14 | 00 | 257 |
| | 20 | 24 | 431 |
| | 33 | 02 | 1050 |
| | 41 | 47 | 1531 |
| 3 | 06 | 04 | 2821 |
| | 09 | 46 | 3011 |

Time of beginning and end of Solar Eclipse of November 30th, 1834, observed at Cincinnati, Ohio. By Elisha Dwelle, Surveyor-General's Office, and John Locke, M.D.

| | h. | m. | sec. |
|-----------------------------|----|----|------|
| Observed time of beginning, | 0 | 3 | 39.7 |
| End, | 2 | 49 | 39.7 |

There were a few clouds in the morning, but by eight o'clock they were nearly dissipated, and the weather was in every respect favourable for observation.

The thermometer, in the shade, sunk during the observation from 46° to 44° , but rose afterwards to 48° . Venus was distinctly visible, and Antares and Lyra were seen by some observers.

Observations made on the 30th of November 1834, at Nashville, Tennessee. By James Hamilton, Professor of Natural Philosophy in the Nashville University.

The day was unusually pleasant, and as not a cloud was visible, the opportunities of observation were very favourable. The situation of observation was at the University buildings, about three quarters of a mile east of south from the public square of Nashville, in latitude $36^{\circ} 9' 32''.66$, as is believed from many very careful trials, and in longitude about 5 h. 47 m. 16 sec. west. The latitude of the square, as determined by circumpolar stars, is about $36^{\circ} 10' 7''$. The local time was obtained by equal altitudes of the sun, taken by a superior sextant, previously adjusted with much care. The time of the sun's passage through the wires of a transit instrument, not adjusted however precisely to the meridian, but of which the deviation had previously been ascertained, was also noted to obtain the error of the chronometer. The result differed from the former but one-tenth of a second. Unfortunately, in ascertaining the error of the chronometer, the beginning of the eclipse was not observed, but the end was looked for with unremitting vigilance, and occurred at 2 h. 41 m. 45.2 sec.

The telescope used for observation was one of Dollond's refractors; the power used was 50, which was preferred to the 80 or 100, because it gave a much clearer view than these latter.

Venus was seen during one hour and three quarters. Two thermometers, Fahrenheit's scale, were placed in the sun, one of which had the bulb covered with thin blackened paper. Another thermometer was suspended on the north side of a brick building, and was of course in the shade.

| Time. | Thermometer in the Sun. | | Therm. in Shade. | Barometer. |
|-------|-------------------------|-----------------|------------------|------------|
| | Naked bulb. | Blackened bulb. | | |
| h. m. | deg. | deg. | deg. | deg. |
| 11 23 | 66.5 | 82.5 | 47 | 29.710 |
| 33 | 67 | 87 | 47 | 710 |
| 43 | 69.5 | 87 | 47 | 700 |
| 53* | 70.5 | 87 | 47 | 695 |
| 12 03 | 72 | 87 | 47 | 670 |
| 13 | 69.5 | 80 | 47.5 | 662 |
| 23 | 66.5 | 76.5 | 48 | 658 |
| 33 | 66.5 | 75 | 47.25 | 650 |
| 43 | 66 | 72.5 | 48 | 640 |
| 53 | 66 | 71 | 47 | 638 |
| 1 03 | 63 | 64.5 | 46.25 | 630 |
| 13 | 59.5 | 59.5 | 46 | 630 |
| 23† | 56.5 | 56 | 45.5 | 625 |
| 33 | 57 | 57.5 | 45 | 618 |
| 43 | 57.5 | 59.5 | 45 | 610 |
| 53 | 61.5 | 64.5 | 46 | 610 |
| 2 03 | 64 | 69 | 46.5 | 620 |
| 13 | 66.5 | 69.5 | 48 | 620 |
| 23 | 68 | 73 | 48 | 610 |
| 33 | 68 | 73 | 48 | 600 |
| 43‡ | | | | |

It will be seen from these observations that the naked thermometer in the sun continued to rise until ten minutes after the eclipse began, when it stood at 72° . That the blackened thermometer had then risen to 87° , and that at the greatest obscuration both had fallen to nearly the same degree; the naked thermometer to 56.5° through 15.5° ,

* Eclipse begins.

† Greatest obscuration.

‡ Eclipse had ended.

blackened to 56° through 31° . The thermometer in the shade fell only two degrees, from 47° to 45° . The changes of the thermometer in the shade, as well as of the barometer, present some anomalies, no doubt caused in both by the sudden diminution of heat. The descent of the mercury in the barometer generally continues with much uniformity until about three o'clock, when it reaches the minimum position. On this occasion it rose a little about two o'clock, and after twenty minutes fell again. At twenty minutes past one o'clock a lens one foot in diameter, whose principal focal length is two feet, was not able to collect sufficient rays to burn blackened paper, though perfectly dry; but when brought to bear upon the bulb of a thermometer for two minutes, caused a rise from 54° to 57° .